

Pest Leaflet

Pacific Forestry Centre

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Common Woolly Aphids of Conifers in British Columbia¹

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Introduction

The term "woolly" aphids is frequently used to describe any of a large number of aphids characterized by having a noticeable white waxy covering. Conifer-feeding woolly aphids of the genera *Adelges*, *Pineus* and *Mindarus* are common throughout British Columbia and may be found feeding on the needles and bark or in twig galls (*Adelges* and *Pineus* only). Most native conifers are affected except cedars, cypresses and junipers. Many species of *Adelges* and *Pineus* alternate between a primary host (spruce) where they induce the formation of twig galls which form around and enclose the feeding nymphs and a secondary host where no galls are formed and the nymphs feed externally. *Mindarus* and some species of *Adelges* and *Pineus* are confined to a single host and do not cause gall formation. Damage caused by the different species of woolly aphids includes chlorosis, stunting and twisting of needles as well as galling and gouting of the twigs. Severe and chronic infestation may result in loss of foliage, growth reduction or mortality.

¹ More detailed information on the balsam woolly aphid, *Adelges piceae* (Ratz.), and the Cootsy spruce gall aphid, *Adelges cooley* (Gillette), are provided in FPL's 1 and 8.

Balsam Twig Aphid

Hosts and distribution

The balsam twig aphid, *Mindarus abietinus* Koch (Homoptera: Aphididae), has a holarctic distribution including much of British Columbia. Host species recorded in British Columbia include alpine fir, *Abies lasiocarpa* (Hook.) Nutt., amabilis fir, *A. amabilis* (Dougl.) Forbes, and grand fir, *A. grandis* (Dougl.) Lindl. Outside British Columbia it is known to attack at least six additional species of true firs.

Description

Egg: Ovoid, about 0.5 mm long, yellow when newly laid, becoming shiny black after about three days; covered with white waxy threads.

Nymph: There are four nymphal stages, typically ovoid in appearance, from 0.5 to 1.7 mm long. First generation appearing in spring (stem mother) is pale brown, later becoming green with white waxy bloom and "wool" around it. Subsequent generations are similar but yellow-green.

Adult: Similar to nymphs, 0.5 to 2.0 mm long. Females green-brown, yellow-green or yellow-

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Fig. 1. Feeding colony of *Mindarus abietinus*.

brown, with or without the white waxy bloom or wool; most of the second generation are winged. Males are elongate, smaller than females and brown or brown-green.

Life history and habits

The balsam twig aphid completes its life cycle on one host producing several generations per year. The wingless stem mother generation develops from overwintered eggs, and gives rise viviparously (young born alive) to wingless females. Successive viviparous non-sexual generations of winged and wingless females are produced until early summer. The last generation of the cycle is sexual consisting of females and males.

Eggs, laid by the sexual females in July, overwinter and hatch in April or May when host buds begin to elongate. Stem mother nymphs move to the expanding buds to feed on immature needles. In May or June, nymphs of the second generation are found feeding in colonies on flushing shoots, producing honeydew and a white waxy wool bloom on the twigs (Fig. 1) Most aphids in subsequent generations develop into winged females which are easily dispersed by wind currents to uninfest-

ed sites. Females of the final sexual generation lay one or two eggs cemented to the base of a needle or on the bark of new growth. Activity is usually completed by mid-July and only the eggs persist until the following spring.

Damage and detection

The balsam twig aphid feeds on new foliage in spring and early summer, causing deformation and stunting of the needles and elongating shoots (Fig. 2); in severe cases needle drop may occur. This damage can be serious in Christmas tree plantations, as damaged trees may be unmarketable. Feeding colonies are easily recognized by the white woolly wax deposits, the profusion of honeydew and a black sooty mould which is characteristically found in association with dense colonies of aphids.

A second species, *Mindarus obliquus* (Cholodkovsky) occasionally infests immature spruce in nurseries and seed orchards.

Large conifer aphids *Cinara* spp. are sometimes found on terminal twigs of *Abies* spp. but are easily distinguished by their large size, long legs and lack of prominent white powdery deposits.



Fig. 2. Deformed foliage on amabilis fir.

Control

Biological: The balsam twig aphid is preyed upon by syrphids, lady beetles and lacewings.

Chemical: Control measures are not practical or necessary under forest conditions. In nurseries and on ornamentals, control may be desirable to assure good growth and eliminate foliage damage. In Christmas tree plantations, control may be required during the last two years prior to harvest. Various insecticides recommended for aphid control may be applied when aphids first become active in spring.

Adelgids

Hosts and distribution

Adelgids are common throughout the holarctic region. More than 20 species occur in North America, with 11 species recorded from British Columbia (Table 1).

Many species utilize two hosts; spruce (*Picea* spp.) is the primary host; secondary hosts include pine (*Pinus* spp.), larch (*Larix* spp.) or Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) (Table 1). Other species of adelgids exist only on a single host genus including spruce (*Picea* spp.), true fir (*Abies* spp.), larch (*Larix* spp.), hemlock (*Tsuga* spp.) or pine (*Pinus* spp.).

Description

Egg: Ovoid, yellow-green to reddish brown, about 0.5 mm long

Nymph: Broadly ovoid to tapered spheroid, wing pads may be present, 0.3 mm to 0.7 mm long; yellow to red-brown after hatching, later stages dark brown to black, fringed or covered with white, waxy wool.

Adult: Wingless forms sessile similar to nymph, usually more tapered posteriorly, 1 mm long; rusty brown to purplish black, covered with white, waxy wool; winged forms without wool, up to 2.4 mm long, with a wingspread of up to 5.6 mm. *Pineus* spp. have four abdominal spiracles, *Adelges*, five.



Fig. 3. *Adelges tsugae* on western hemlock.

Life history and habits

The life cycles of the different species of adelgids are variable and complex. Many species have six forms, alternate between a primary host (*Picea*) and a secondary host of a different genus and require 2 years to complete their life cycle. Other species complete their life cycle in one year on a single host (Figs. 3,4) and lack a sexual generation.

First instar nymphs insert their stylets into the host, and remain at that location until mature. Wingless adults remain sessile and lay eggs; the winged forms may withdraw their stylet and disperse to alternate hosts.

A typical two-host life cycle (Fig. 5) includes one sexual form (sexuales). Each female of the sexuales generation lays a single egg on the primary host (spruce) in mid-summer. A generation of wingless females (fundatrices) emerges in late summer and remains on the primary host, overwintering as second instar nymphs. This generation matures (Fig. 6) and lays a large cluster of eggs in spring about the time the spruce buds are swelling. The nymphs hatching from these eggs (gallicolae generation) crawl to the base of the needles in the expanding shoot, insert their stylets

Table 1. Common B.C. adelgids, their hosts and site of feeding.

Species	Alternate hosts		Feeding Sites
	Primary ¹	Secondary ²	
<i>Adelges abietis</i>	white spruce Engelmann spruce	—	twigs
<i>Adelges cooleyi</i>	Engelmann spruce Sitka spruce white spruce	Douglas-fir	twigs, needles, cones
<i>Adelges nusslini</i>	—	ornamental true firs	bole, twigs, needles
<i>Adelges oregonensis</i>	—	western larch	twigs, needles
<i>Adelges piceae</i>	—	true firs twigs, buds	bole, branches,
<i>Adelges tsugae</i>	—	western hemlock	bole, branches, twigs
<i>Pineus abietinus</i>	—	true firs	bole, branches
<i>Pineus coloradensis</i>	—	lodgepole pine Scots pine, ponderosa pine, western white pine	needles
<i>Pineus pinifoliae</i>	Sitka spruce white spruce black spruce Engelmann spruce	western white pine	twigs, needles
<i>Pineus similis</i>	Sitka spruce white spruce Engelmann spruce	—	twigs
<i>Pineus sylvestris</i>	—	Scots pine	twigs

¹ Green to purple galls on twigs.² Woolly tufts on needles and/or bark, yellow spotting of needles.

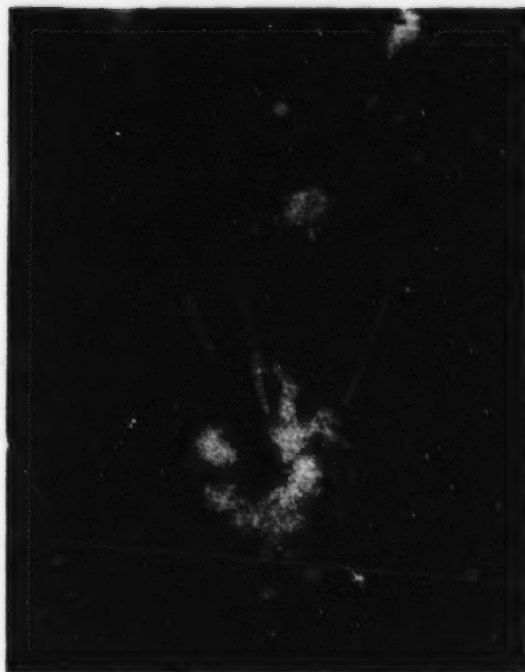


Fig. 4. *Pineus coloradensis* on lodgepole pine.

and begin to feed. This feeding activity stimulates the development of a gall within which the nymphs remain until mature. The form of the gall produced by each species has a distinctive size, color and shape (Figs. 7, 8, 9). Later in the summer the gall opens releasing up to 400 winged adults which disperse to the secondary host where they lay their eggs on the lower surface of the current year's needles. These eggs give rise to the sistens generation which overwinters as first or second instar nymphs (Fig. 10). The sistens mature the following spring producing wingless adults which lay large clusters of eggs (Fig. 11). Progeny from these eggs (progredians) may develop into wingless adults which remain on the secondary host and give rise to additional progredian generations or into winged adults which return to the primary host. The eggs laid by the winged form on the primary host become the sexual generation (sexuales).

Damage and detection

The small size of adelgids precludes species identification with the naked eye; field identification is based upon host, gall-type and damage.

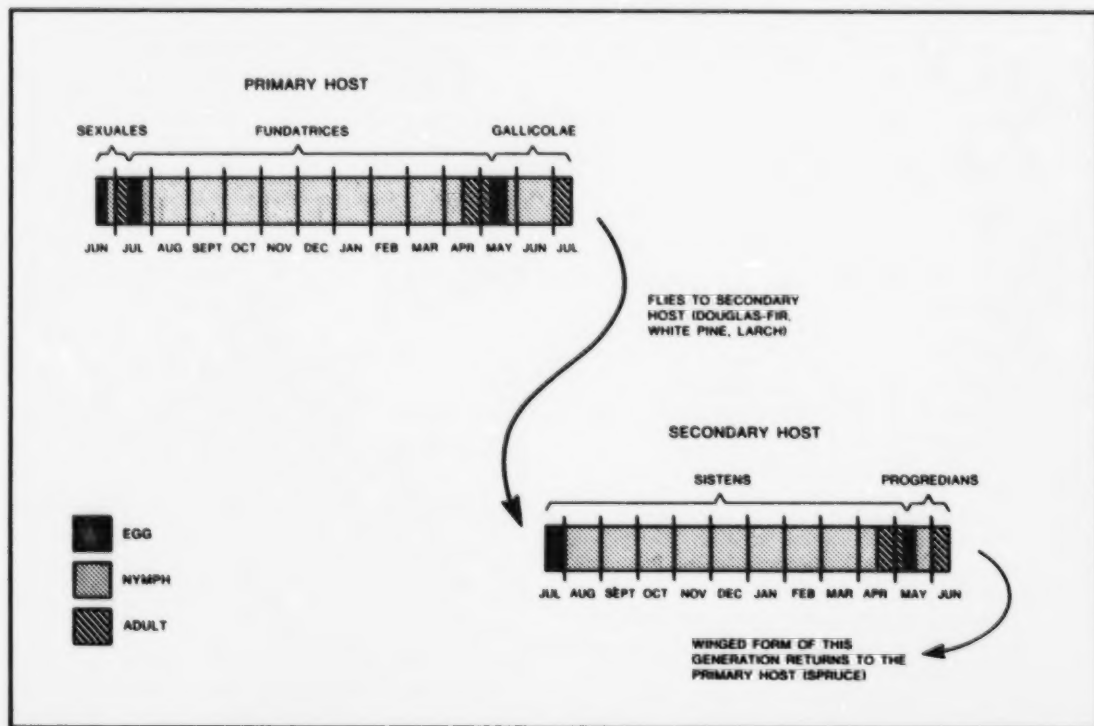


Fig. 5. Generalized life cycle of adelgids alternating between primary and secondary hosts.



Fig. 6. Overwintering *Adelges cooleyae* on spruce.

On spruce: The most obvious sign of adelgid infestation is the cone-like galls on the branches. These may be cone shaped or pineapple-shaped, according to the species of adelgid, and range from pea-size to over 7 cm in length.

Young galls are green shaded with pink or purple, old empty galls turn brown and may remain on the trees for several years. Galls of *Pineus* spp. have interconnecting chambers; *Adelges* galls have separate cells at the needle bases (Fig. 12). Occasionally adelgids in non-gall-forming stages may be present on spruce and appear as tufts of white wool on the foliage.

On other hosts: Galls are not formed, aphids appear as dots of white wool on the foliage (Fig. 13) and bark throughout the summer. The overwintering form appears as tiny black nymphs located on twigs or needles of the current years growth. Foliage feeding by the aphids causes chlorosis and distortion of needles and when severe, needle drop. The balsam woolly aphid feeds on the bark and causes swelling or gouting at the branch nodes and tips.

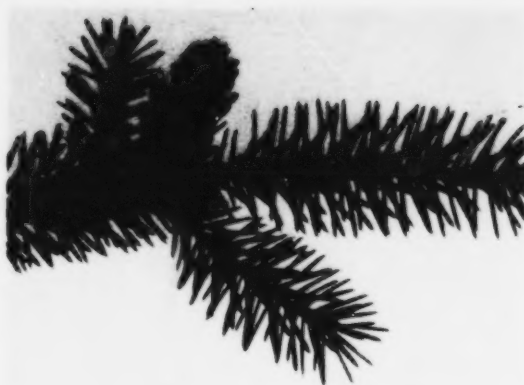


Fig. 7. *Adelges cooleyae* gall on Sitka spruce.



Fig. 8. *Pineus similis* gall on Sitka spruce.

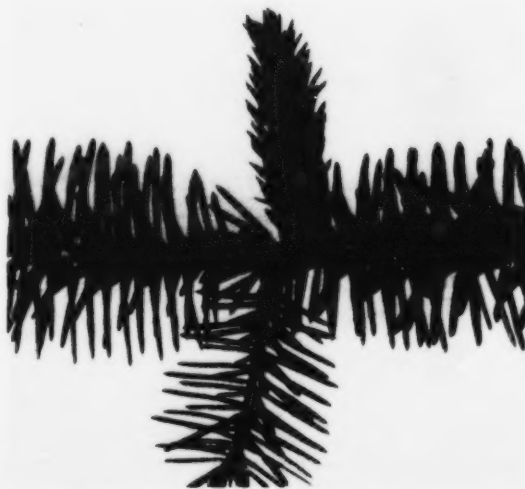


Fig. 9. *Pineus pinifoliae* gall on Sitka spruce.

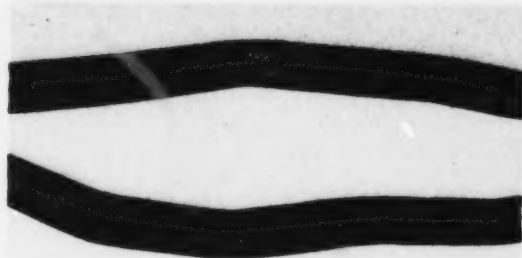


Fig. 10. Overwintering *Adelges cooleyi* nymphs on Douglas-fir.

Control

Biological: Adelgids are preyed upon by over 50 insect predators including several introduced species. None are completely effective at infestation levels.

Chemical: Chemical control is generally not necessary except on high-value trees such as those in parks, nurseries, Christmas tree plantations and seed orchards. Carefully timed sprays of a systemic insecticide will control these insects. Generally insecticide applications are made in spring when buds are swelling and before damage occurs.



Fig. 11. Egg clusters laid by overwintering *Adelges cooleyi* on Douglas-fir.

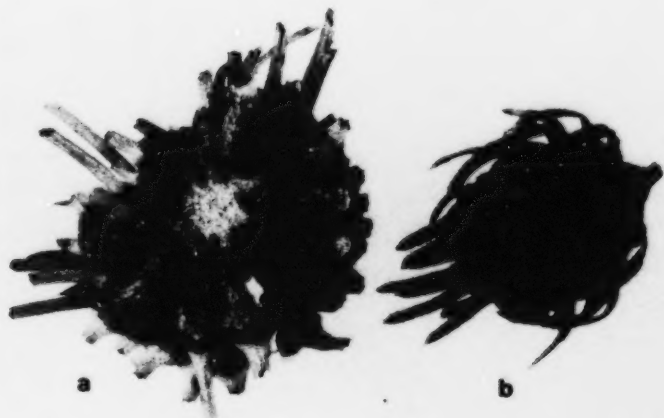


Fig. 12. Cross section of a) *Pineus similis* and b) *Adelges cooleyi* galls



Fig. 13. *Pineus pinifoliae* on western white pine.

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